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ABSTRACT

Research in science education has begun to identify common characteristics of students who continue to participate in school science beyond the minimum requirements. The overall objective of this study was to synthesize research findings in this area and thus clarify the variables and relationships affecting school science participation. Additional studies that deal with prediction of college science or science career participation were also included to augment this objective given their relationship with secondary school science participation. An examination of the literature resulted in the grouping of the research into three categories. First, a picture of the current enrollment in school science was produced from the studies that cite the number of students that continue in science Second, studies that infer relationships about the variables related to continued participation in science were synthesized to characterize avenues for possible interventions. Third, studies that have conducted interventions in students' participation in science provided examples and insights into the future direction for research. (30 references) (KR)

Participation in School Science: A synthesis of recent Research

Discussion Group Paper

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Participation in School Science: A Synthesis of Recent Research

During the 1980's many studies were conducted to examine issues and variables related to student participation in school science. As a construct of research interest, student participation in school science may be defined not only in terms of elective participation in science courses, but also in terms of a variety of other tasks including reading of science material, extracurricular science activities (such as a science club), and pursuit of science at home. This review of research has attempted to examine those studies whose primary emphasis was on factors related to taking elective science courses in high school and in college. Many of these studies examine the issue in light of the characteristics of student sub-groups such as females or members of ethnic minorities (for instance: Atwater, 1986; Goggins & Lindbeck, 1986; and Kahle, 1983). Other studies examine this issue across all student populations and attempt to extract relationships that are widely generalizable (for instance, DeBoer, 1987; Khoury & Voss, 1985; and Oliver & Simpson, 1987). In some cases, reported research is part of an on-going program of systematic and long term research. These programs of research into the factors related to participation in school science have been conducted by several science education researchers such as DeBoer (DeBoer, 1984; DeBoer, 1985; and DeBoer, 1987), Kahle (Kahle, 1983; Kahle, 1984; and Kahle, Matyas & Cho, 1985), and Simpson (Simpson & Troost, 1982; Simpson & Oliver, 1985 and; Oliver and Simpson, 1987).

This review of the literature was initiated to examine the wealth of research that has emerged in the recent years. Sixty five studies covering research during the 1980's have been identified using the ERIC system and Dissertations Abstracts. The results from the studies have been grouped into three categories; (1) studies that describe the current school situation with regard to the number of students that continue in science, (2) studies that infer relationships about the variables related to continued participation in school science, and (3) studies that have conducted interventions aimed at determining the degree to which future participation or intention to participate further can be increased.

Objectives

Research in science education has begun to identify common characteristics of students who continue to participate in school science beyond the minimum requirements. The overall objective of this study was to synthesize research findings in this area and thus clarify the variables and relationships affecting school science participation. Additional studies that deal with prediction of college science or science career participation were also included to augment this objective given there relationship with secondary school science participation.

Specifically, three research questions are addressed.

1) Does a consistent description of student participation arise from the literature of science education?

2) Are there consistent relationships that have emerged between student characteristics and continued participation in science?

3) Do reports of interventions explain how student participation in science can be increased?

Discussion

Two papers published in 1982 can be considered to form a rationale for conducting research on student participation in science. Voelker (1982), in identifying factors related to "attentiveness to science", reported that the diversity of science study "contributes to a higher level of science knowledge" in non-college bound students and "is associated with higher interest, knowledge, information and attentiveness" for college bound students (p. 76). Simpson and Troost (1982) indicated that commitment to science is a desirable goal for science education. They defined commitment to science not merely as a student's desire to major in science, but rather as "the desire to take more science courses, to continue reading about science, to explore new scientific topics, and to be involved in science-related social issues" (p.765). Given this indication that diversity of science study and the taking of more science courses leads to more attentive and committed science students, there is a clear need to understand elective participate in science.

Description of Student Participation. A number of studies have been reported that describe the current level of student science enrollments (for instance: Blank, 1987; Doran, et.al, 1986; Goggins & Lindbeck, 1986; Wavering & Watson, 1987; and Welch, Harris, and Anderson, 1984). The collective description from these reports forms a core of information about student participation.

Typical of these findings is the report by Welch and his colleagues which

found that school science enrollments are decreasing from the levels of 1960. Between 1977 and 1982 this decrease was reported to be on the order of one-half million students. In the 11th grade of high school 48% of students take a science course; 33% remain in science courses in the 12th grade.

Inferences about student participation. The majority of studies which address the issue of student participation in science make inferences from the observed relationships between student or school characteristics and participation in science. Most prominent among these findings is the report that student feelings and beliefs about their ability to succeed in science are strongly related to their continued participation. One major problem, however, is the variety of means used to measure and define these variables.

Names given include:

(1) "self concept of ability" by DeBoer (1987). DeBoer stated that this construct was measured by the following six items.

> a. I was very successful in this course.
>
> b. The course was easy.
>
> c. I worked hard in this course.
>
> d. I have a lot of ability in this area.
>
> e. I plan to take more chemistry next year.
>
> f. When/If I take another course in chemistry, I will do very well. (p. 531).

(2) "science self concept" by Simpson & Troost (1982). Science self concept was measured by the use of two items on a 54 item scale. These items were:

a. I consider myself a good science student.

b. I think I am capable of becoming an engineer, scientist or doctor.

(3) self report of "high aptitude in science" by George, Wystrach & Perkins (1987), which was reported through a single item on an instrument.

(4)"role-specific self-concept in science" by Baker (1987), which was measured by the Bem Sex-role Inventory. Interestingly, though, Baker reported that although women had a lower role-specific self-concept there was no difference in self-reported ability.

(5)"self-schema for math/science ability" by Lips (1984) which was measured by the use of responses on items that measured,

a. Mathematical inclination,

b. Ability with "numbers,

c. Ability with abstract reasoning,

d. Enjoyment associated with learning about science,

e. Importance to self-concept of mathematical inclination,

f. Importance to self concept of ability with numbers,

g. Importance to self concept of abstract reasoning ability,

h. Importance to self concept of enjoyment of science.

However, a generally accepted finding is that a students belief in her/his ability to succeed, in its variety of measured forms, is a major predictor of later participation (Baker, 1987; DeBoer, 1984; DeBoer, 1985; DeBoer, 1987; George, Wystrach, & Perkins, 1987; Oliver & Simpson, 1988; and Salters, Lockard & Stunkard, 1987).

Interventions for student participation. The final component of this synthesis

are studies that have conducted an intervention with regard to participation in science. Successful interventions are an important outcome of this type of research, given the belief that increased participation in science is an important goal. Though not common, several studies were found (for instance: Gardner, 1986; and Wessels, 1987). As a example of an intervention aimed at student participation, Wessels (1987) explored the use of audiovisual presentations to young women concerning careers in science which contained factual information only as compared to presentations which contained factual and lifestyle information. The author concluded that the addition of lifestyle information to the presentation was more effective in producing positive attitudes toward careers in science than presentations with factual information alone.

Summary

A synthesis of recent research on participation in science offers an opportunity to pull together findings from a large body of research and to make serious comments about the practice of science teaching. This review attempts to make both of those contributions.

While it is probably true that a student's participation in elective science courses will not necessarily lead to that student becoming scientifically literate or attentive, it is probably also true that students who completely forsake the study of science beyond the minimum level will lose the opportunity to become scientifically literate or attentive. Given that, this examination of the research on student participation gives an essential component of the information needed to address the

larger issue of scientific literacy.

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